

1. A method of repairing a mitral valve in the heart of a patient, such method comprising the steps of:  
inserting a catheter through the atrium to the mitral valve, the catheter having a distal end and a proximal end;  
gripping opposed leaflets of the mitral valve with the distal end of the catheter so as to effectively juxtapose the opposed leaflets at a point thereof; and  
fastening the opposed leaflets at said point.

2. The method of claim 1, wherein the step of gripping is performed while the heart is beating.

3. The method of claim 2, wherein the distal end of the catheter includes opposed openings and a suction lumen, and wherein suction is applied through the lumen to draw said opposed leaflets together.

4. The method of claim 3, wherein the step of fastening includes stapling.

5. The method of claim 4, wherein the stapling is effected by inserting a stapling device to said point from a direction opposite the direction in which the catheter was inserted.

6. The method of claim 5, wherein said catheter further comprises means for extending a guide wire beyond the point of juxtaposition, and the step of stapling includes inserting said stapling device along the guide wire to guide said stapling device to said point.

7. The method of claim 5, wherein the stapling device includes jaws actuated by a balloon such that inflation of the balloon deploys a staple through the leaflets.

8. The method of claim 2, wherein the step of fastening is effected by the catheter.

1 9. The method of claim 8, wherein the step of fastening is effected by deploying a  
2 shape memory fastener such as a staple or rivet from within the catheter.

1 10. The method of claim 9, wherein the shape memory fastener is deployed from the  
2 distal end of the catheter by the distal translation of a placement device.

1 11. The method of claim 10, wherein the placement device is a plunger..

1 12. The method of claim 8, wherein a fastener is deployed from the distal end of the  
2 catheter by translation and rotation of a placement device in the distal end of the catheter.

1 13. The method of claim 12, wherein the placement device is a telescoping cylinder.

1 14. The method of claim 2, wherein the catheter includes a suction lumen, and further  
2 comprising the step of inflating an obstruction balloon at said distal end of the catheter to  
3 define lateral suction paths, and wherein the step of gripping opposed leaflets of the mitral  
4 valve is performed by capturing mitral valve tissue with said suction paths against the distal  
5 end of the catheter.

1 15. The method of claim 14, further comprising the step of providing a mechanical  
2 fastening assembly in said distal end, and wherein the step of fastening is performed using  
3 said mechanical fastening assembly.

1 16. The method of claim 15, further including the step of obstructing the end of the  
2 catheter with a balloon to deflect ends of the fastener into the leaflets.

1 17. The method of claim 9, wherein the shape memory fastener is formed of a material  
2 selected from the group consisting of superelastic material and shape memory alloy  
3 material.

18. A method of repairing a mitral valve in the heart of a patient, such method comprising the steps of:

- inserting a catheter along the venous system of the patient to approach the mitral valve through the atrium;
- applying suction at a distal end of the catheter to draw opposed leaflets of the mitral valve into contact;
- extending a guide wire from the catheter into the ventricle and along the arterial system of the patient; and
- guiding a stapling device along said guide wire to the opposed leaflets to staple the opposed leaflets together while the heart is beating.

19. The method of claim 18, wherein the stapling device includes a stapling mechanism actuated by a balloon such that inflation of the balloon deploys a staple pin to the leaflets.

20. A method of repairing a mitral valve in the heart of a patient, such method comprising the steps of:

- inserting a catheter along the venous system of the patient to approach the mitral valve through the atrium, the catheter having a distal end and a proximal end, the catheter containing a fastener, and the catheter also having a balloon, a fluid inflation line, and a plunger device attached thereto;
- applying suction at the distal end of the catheter to draw opposed leaflets of the mitral valve into contact;
- inflating the balloon via the fluid inflation line;
- using the plunger to move the fastener distally out of the catheter; and
- causing the fastener to curl around the inflated balloon such that its ends penetrate and fasten together the opposed leaflets.

21. A diagnostic method for repair of a mitral valve defect, such method comprising the steps of:

- visualizing mitral valve function by transesophageal echocardiography;
- inserting a catheter along the venous system of the patient to the mitral valve;

5 applying suction at the tip of the catheter to draw opposed leaflets of the valve  
6 together at a selected point;  
7 visualizing mitral valve function by transesophageal echocardiography to confirm  
8 the efficacy of fastening the selected point to repair the defect; and  
9 fastening the opposed leaflets at said point.

1 22. An endovascular device for cardiac treatment, such device comprising:  
2 an elongated catheter body adapted for percutaneous insertion along the venous  
3 system of a patient to the heart; and  
4 a suction assembly disposed at a distal end of said catheter body, the suction  
5 assembly being effective to define negative flow into said catheter body along opposed sides  
6 thereof,

7 whereby insertion of the catheter into the atrium with the distal end of the catheter  
8 positioned in the mitral valve is effective to draw opposed leaflets of said mitral valve  
9 together in juxtaposition for simulating an Alfieri leaflet stitch repair.

1 23. The device of claim 22, wherein the distal end of the catheter includes opposed  
2 openings that provide a suction force, and wherein said distal end of the catheter has a  
3 preformed contour effective upon penetration of the atrial septum to position the distal end  
4 of the contour in the mitral valve.

1 24. The device of claim 22, further comprising means in said catheter for  
2 accommodating a guide wire.

1 25. The device of claim 24, further comprising means for advancing a guide wire  
2 through said catheter and along the arterial tree of the patient.

1 26. The device of claim 25, further comprising a stapling device adapted for  
2 percutaneous insertion and for travel along said guide wire such that the stapling device  
3 may be positioned to staple the opposed leaflets drawn together by the distal end of the  
4 catheter assembly.

1 27. A method of repairing a mitral valve, such method comprising the steps of:  
2 immobilizing opposed leaflets of the mitral valve with an endovascular catheter  
3 assembly inserted from a first direction; and  
4 stapling the immobilized leaflets with a stapling device inserted from a direction  
5 opposite to said first direction.

1 28. The method of claim 27, wherein the step of stapling is performed by guiding a  
2 stapling device to a tip region of the catheter assembly along a transcatheter wire.